In Search of Group Optimality
An Examination of the Effects of Anonymity and Task Complexity on Group Performance

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This study explores the effects of anonymity on group behavior and structure. We hypothesize that there is an optimal degree of anonymity for each type of task complexity. A completely anonymous group is expected to outperform its semi-anonymous counterpart on brainstorming tasks. However, we expect the greater knowledge of team structure and the high trust and cohesion that exist in semi-anonymous groups to help these groups do better on decision making tasks. This study further examines the role of trust in encouraging information sharing and critical evaluation. We find that high levels of trust may not be optimal when it leads to groups lowering their evaluation of teammate's suggestions. In this case a certain amount of distrust may be the key to strong group performance.

Introduction

We are in the midst of a communication revolution. The rise of the Internet, cell phones, and Blackberrys has led to a rapid increase in non-facial communication through e-mail, instant messaging, text and picture messaging on cell phones, and even online blogs. Businesses have been on the leading edge of this technology wave and frequently use these new innovations to help their workers communicate more effectively. However managers must be aware that virtual communication changes the process of group interaction and can strongly affect the optimal structure of a team.

In all organizations, developing individuals into working teams is an important tool that managers wield. They are aided in this endeavor by a myriad of academic research in the

area of group interaction and decision making. Early research in this field examined the effects of anonymity on group work performance, while contemporary research has primarily focused on the effects of the anonymous communication medium created by computers compared to face-to-face interactions.

However, little research has explored the effects of varying anonymity while holding the method of computer-mediation communication constant. As a result, we focused our research on filling this gap by investigating how performance varies as the anonymity of the computer-mediated groups is modified. It is our belief that various levels of anonymity will be best suited to particular task types. Therefore we will also examine the effects of varying task complexity on the performance of teams. The primary prediction is that anonymous groups will be best suited to brainstorming tasks, while semi-anonymous groups will be best suited to more complex decision making tasks.

Background

Process Loss in Groups

The old adage that the whole is greater than the sum of its parts often does not apply to teams. Process loss causes most groups to perform well below their potential. Reasons for this process loss can best be explained by status incongruities, free-riding, and normative pressures to conform (Steiner, 1972). It is this last contributor, normative social pressure, which creates the most process loss in groups since it strongly affects the ideas that are shared and accepted. The problem with normative influence is that it can cause critical information to remain unshared (Gigone and Hastie, 1993). In short it is easier to discuss shared information that has already been agreed upon then consider disparities that result from new information. Since normative influence is a key factor in determining what information gets exchanged and emphasized in group discussion it can lead to group overconfidence (Sniezek, 1992) and less extensive generation of ideas during discussion of decision materials (Crott *et al.* 1998). Most importantly, high levels of normative pressure leads to poorer decision making (for review, see Shul-Hardt *et al.* 2000). Thus it is important to monitor the extent of social influence on group decisions.

As we will see anonymity plays an important role in diffusing these harmful forces. Our research sheds more light on this topic and further explores the optimal group structure that will best combat the process loss created by normative social pressures, status disparities, and free-riding.

Group Development

It is clear that not all groups perform to the same standard. One explanation for the varying aptitude of groups is the extent of their development. At different points of maturity groups tend to focus on different priorities. Tuckman and Jensen (1977) helped originate the idea that most teams go through four stages of group development: forming, storming, norming, and performing. Through this process teams develop from an inhibited, information-seeking group to a team focused on particular tasks with defined goals and norms to regulate behavior. Newly formed teams often experience high-levels of production blocking because the team must first attempt to establish social norms as to what level of performance is acceptable and thus have less time to focus on the task (Paulus and Dzindolet, 1993). Teams in the performing stage function as a unit with high competency. Tuckman and Jensen proposed that communication was the easiest in the performing stage because procedures had already been developed (most likely intrinsically and not formally) for communication.

The Role of Task Difficulty

A good deal of incongruence exists in the current research on group decisions and the effects of anonymity. The mixed results obtained in previous research have led some academics to further examine the role of task type in group decisions. These researchers speculate that the task type that groups are asked to complete in an experiment can have a significant impact on their performance. Jessup *et al* suggest that task commitment might be an important moderator (1990). We believe that task complexity is a significant contributor to the differences in performance between anonymous groups and face-to-face groups and that modifying team's structures to match the complexity of the task will result in more optimal decision making and reduced process loss.

Brainstorming Tasks

Examining decision making in brainstorming tasks has been a popular focus of researchers. Brainstorming can be defined as a group performance technique designed to facilitate creative thinking (Osbourn, 1957). Early research on brainstorming showed that there is a significant amount of process loss in brainstorming groups. In fact, at times these groups did only half as well as nominal groups (Lamm and Trommsdorff, 1973). This wide discrepancy in performance can be attributed to the high amount of production blocking that

occurs. Production blocking is caused by a myriad of factors including: the ability for only one group member to speak at a time, the need for members to listen to one another, the lag time in waiting for one's turn to speak, and the difficulty in trying to not interrupt others. All of these difficulties create mental blocking that can derail existing trains of thought (Nijstad, 2000).

The obstacles of brainstorming in groups can be circumvented when teams communicate through computer systems. In order for computer mediation to work effectively the computer software must allow individuals to submit ideas without interruption in order to stop mental blocks or forgetfulness, it must allow individuals to be anonymous in order to lower their evaluation apprehension, and it must permit all contributions to be viewed simultaneously in order for teams to jump-start new trains of thought (Gallupe *et al.* 1991). Groups that are aided by computer systems can do better not only because each individual can contribute his or her ideas unimpeded, but also because members build off of others' ideas – in fact a stimulating effect is created (Kerr and Tindale, 2004).

Our experiment will further investigate whether creating a heightened degree of anonymity by routing communication through computer systems will help teams effectively overcome the mental blocks that often occurs in brainstorming tasks.

Decision Tasks

There are sharp differences between a brainstorming task and a decision making task. A decision task requires teams go through a multi-stage process in order to reach a consensus, while a brainstorming task requires little to no consensus among members. It is for that reason that success in a decision making task is contingent upon teams working cohesively with a high range of trust and free expression.

While it seems that many of the process losses in brainstorming groups can be combated by increased anonymity, this may not always be true in decision making groups. There are adverse affects of increased anonymity that can severely hamper a decision making group, mainly that it can encourage social loafing and free-riding. Social loafing can be disastrous in decision making groups because of the possibility that critical information for the task is not shared among group members. However it has been shown that social loafing can be abated if group cohesion (Everett *et al.* 1992) or motivation is sufficiently high.

Another significant factor to the success of decision making groups is the amount of minority influence on the team. Minority influence is important because strong beliefs by an in-group member can cause groups to think more critically about their decisions and the more critically groups examine their decisions the better they will perform. While this has been shown to be true in face-to-face groups, not all research has supported this outcome in anonymous groups. McLeod *et al.* claimed that minority influence is only significant in face-to-face settings (1997). It seems that the majority appreciates the courage and commitment it takes to express dissenting opinions in face-to-face settings and thus is more willing to think critically about all suggestions. In anonymous situations this courage is not evident and therefore teams don't value minority opinions as highly.

It appears that increased anonymity can actually hamper decision making groups by encouraging social loafing and decreasing the impact of important minority contributions. Strong group trust and cohesion, however, can help overcome both of these effects and leads us to believe that the semi-anonymous group will have a distinct advantage in completing the decision making tasks.

Computer-Mediated Communication

Communicating virtually with the assistance of computers changes group interactions primarily because of the increase in anonymity that it allows. This increase in anonymity results in a reduction in perceived status differences among group members (Bonito and Hollinshead, 1997) and is of great advantage to the group because members are more likely to contribute freely if they are of equal status (Dubrovsky *et al.* 1991). In addition people who are apprehensive or fearful of rejection will feel more comfortable expressing alternative viewpoints (Dittes and Kelly, 1955) in these situations. Importantly, when people work in anonymous computer-mediated groups, they are more critical and probing, and more likely to embellish on others ideas than those groups which did not work anonymously (Jessup, Connolly, and Galegher, 1990). Other research by Jessup *et al.* showed that when group members worked apart and anonymously, more ideas were generated and discussion was more critical than their non-anonymous counterparts (1988).

It seems that the increase in perceived anonymity by group members when communicating with the assistance of computers can help both a brainstorming and decision making group. However we expect these benefits to present themselves differently in the anony-

mous and semi-anonymous groups and lead to certain task-types being served best by particular group structures.

Hypotheses

While in recent years there has been an increased focus on computer mediated communication, little research has focused on the differences between anonymous and semi-anonymous groups. For this reason we chose to focus our research on this emerging area. Our hypotheses revolve around our belief that anonymous and semi-anonymous groups have different team strengths. It is our belief that the strengths of the anonymous group will allow them to perform better on the brainstorming task, while the strengths of the semi-anonymous group will lead them to performing better on the decision making task.

Brainstorming Task

We hypothesize that the anonymous group when completing the brainstorming task will do significantly better than the semi-anonymous group. The ability of the anonymous group to feel greater freedom of expression, have low evaluation apprehensions, and be more accepting of others ideas will allow them to accomplish the critical tasks of considering more idea and being more critical and probing of their answers than the semi-anonymous group. We expect three main causes to spur this result: lower normative pressure, lower evaluation apprehension, and the absence of strong roles within the group.

Lower normative pressure is expected in the anonymous group because members should feel greater levels of anonymity. This should occur because team members will interact under secret usernames and have no knowledge of who their teammates are, unlike the semi-anonymous group. Thus they should feel lower pressures to conform to the group decision.

The increase in anonymity should also lead to a lower level of evaluation apprehension. As previous research has shown, the lower apprehension and lower fear of rejection should encourage team members to contribute a wider range of ideas. These creative and atypical ideas will in turn create a stimulating affect that will result an even wider range of ideas.

Lastly the absence of strong roles within the group should help them complete the brainstorming task better than the highly structured semi-anonymous group. The lack of

defined roles means that each member has not cemented themselves into a role that confines their thinking.

Decision Making Task

We expect the semi-anonymous group to do better than the anonymous group on a decision making task because of their ability to reach a decision more effectively, have more purposeful discussions, and interact critically. We hypothesize that three main causes will prompt this result: less social loafing, high knowledge of group strengths and dynamics, and greater minority influence.

We expect less social loafing to occur in the semi-anonymous group for three main reasons. First since semi-anonymous teams will see each other soon after the experiment we would expect members to feel a stronger need to contribute to the group because they are more wary of the consequences of free-riding than the anonymous group. Secondly we expect that the semi-anonymous group will have higher group cohesion then the randomly assigned anonymous group and thus feel more of an obligation to not socially loaf off of their teammates. Lastly we expect a high level of trust to exist between group members which should lead members to feel more willing to contribute to the team's effort.

The prior knowledge of group strengths and dynamics will allow the semi-anonymous members to complete the decision making task better than the anonymous group because they will be able to immediately start to work effectively without the need to orient themselves. The semi-anonymous group has passed the forming and norming stages of development (as described by Tuckman and Jensen, 1977) and are in the performing stage where they will work most effectively. The combined strengths that the semi-anonymous group has in already knowing their roles, how they best contribute, and the strengths of their other team members combined with the positive effects of anonymity will allow them to perform very well on the decision making task.

The final key reason why the semi-anonymous group should do better than the anonymous group at a decision making task lies in the role of minorities. Minority influence is more important in decision making tasks because it is critical that all relevant information is shared in order to arrive at the correct decision. Minority opinions in the semi-anonymous group will have a greater influence because of the higher levels of trust and cohesion

that exist. These minority opinions will help promote greater group discussion and encourage group members to think more critically.

Experiment

The study asked students at the University of Pennsylvania to use an instant messenger program in order to compete in brainstorming and decision making tasks while interacting to varying degrees of anonymity. The dependent variable was the overall performance of each group. The task type and the degree of anonymity and familiarity between the group members were manipulated and each participant was asked to complete a survey expressing their opinion of the group's interaction.

Method

Participants and design:

The experiment was run on forty-five students at the University of Pennsylvania. The anonymous groups were made up of twenty-five walk-in participants who responded to an e-mail publicizing the experiment and the semi-anonymous groups were made up of twenty self-selected participants. Each group was made up of four members who were self-selected in the semi-anonymous groups and randomly assigned in the anonymous groups as each participant walked-in. The group participants interacted over an MSN Messenger program in chat rooms moderated by the experiment administrator. Participants were paid $10 for their participation in a bundle of unrelated tasks that included this experiment.

Experimental Procedure:

To ensure anonymity each group member was given a confidential username and assigned a computer secluded from their team members. The groups participated in two games. The first game was a simple word building game whose purpose was to act as a warm-up and allow the users to get used to interacting in the chat room and with each other.

The second game varied by the task type being tested, either brainstorming or decision making. Groups participating in the brainstorming task were asked to do the following:

> The game focuses on your team's ability to brainstorm as many names as possible that are recorded in the U.S. Social Security Administration's ranking of the Top 100 most common *female* Baby Names of 2005. The rules of the game are as follows: Your team will have 8 minutes to generate as many of the Top 100 most common female baby names as possible. Teams will receive 100 points if their list includes the #1 baby name of 2005 and each subsequent name will receive one point less (i.e. The 30th name receives 70 points, the 90th name receives 10 points). The highest possible score is 5050.

Groups participating in the decision making task completed a similar experiment that asked them to do the following:

> The game focuses on your team's ability to correctly choose the Top 10 names that are recorded in the U.S. Social Security Administration's ranking of the Top 100 most common *female* Baby Names of 2005. The rules of the game are as follows: Your team will have 8 minutes to decide on the Top 10 most common female baby names of 2005, and list them in order. At the end of your 8 minute limit, you will be notified of one additional minute to list your final answers in order from 1 to 10. For each name listed, points will be given if it is in the Top 100 list based upon its ranking. The #1 baby name of 2005 will receive 100 points and each subsequent name will receive one point less (i.e. The 30th name receives 70 points, the 90th name receives 10 points). Bonus points will be rewarded for teams that correctly identify names in the Top 10. Teams who do this will receive an additional 100 points per name. The highest possible score is 1955.

After the experiment was finished, each participant was also asked to complete a post-game questionnaire in order to assess why certain groups performed better and to provide evidence for our hypotheses.

Results

Manipulation Check:

To assess whether the manipulation of the degree to which team members knew each other was successful, we examined the mean responses to the question: To what extent did you know the other members of your team before the experiment? Results show that the participants in the anonymous groups rated themselves as significantly less knowledgeable of their team members (M = 1.45) than the semi-anonymous groups (M = 5.69, t = 74.969, p = .0000). Between the anonymous and semi-anonymous groups there was no significant difference across the demographic checks of age, gender, MSN Messenger familiarity, class year, primary school, or knowledge of English (p = .19 to .82). Thus the group knowledge manipulation does not appear to have perturbed the other group measures.

While the manipulation needs to hold across anonymity, we don't expect it to hold across task type. This also proved true; when examining the manipulation across task type it is clear that that the knowledge manipulation is not significant (p = .580). Examining common demographics between task types also reveals that there was no significant difference in the group make-ups (p = .819 to .943)

Analysis

The post-game questionnaire resulted in many answers that were statistically significant even with such a small sample size. The analysis was generated using the average group response in order to accurately assess answers to the survey questions. We are most interested in the responses at the group level and not at the individual level within the group and thus the analysis was conducted comparing the group means across the degree of anonymity, task type, and across both anonymity and task type combined in a four way condition table.

Anonymous vs. Semi-Anonymous Groups:

Significant differences were found between the groups when asked whether they felt they would receive negative consequences from their team if they didn't contribute (q9, p = .030) and accordingly if they felt obligated to contribute because they owed it to their team (q12, p = .078). In both of these cases the anonymous group answered to a stronger

degree that they felt high pressure from their team to perform to a sufficient level. Differences were also evident between the anonymous and semi-anonymous group when they were asked questions dealing with trust and acceptance. The semi-anonymous group answered significantly more strongly that they felt there was a high level of trust on the team (q21, p = .004) and that all suggestions, no matter how unusual or strange, were acknowledged by the team (q23, p = .041).

Brainstorming vs. Decision Making Task:

As expected when comparing the group means across task type instead of anonymity different responses were significant. Groups participating in the brainstorming task reported that they felt freer to suggest unusual ideas once someone else in their group did (p = .071), while those taking part in a decision making task reported a greater division of positions on the team. The decision making groups felt that more defined roles emerged within the team (p = .037) and that there was a clearer leader on the team (p = .066). They also reported that they felt more free to question other people's ideas in the group than their brainstorming task counterparts (p = .061). Members involved in the decision making task also reported that they had a lot of influence over their team's activities (p = .041) and accordingly a great deal of power relative to other team members (p = .092).

Four-way Condition Analysis: Anonymity vs. Task Type

The final ANOVA analysis examined the group means by all four conditions. This test most clearly presented the data that supported our hypotheses of the interaction between task type and the degree of anonymity. The test showed that the Anon-DM groups felt more strongly that defined roles emerged within the team (q6, p = .059) and that there was a clear leader on the team (q7, p = .067). In contrast the Semi-BS groups felt the exact opposite - that little roles emerged (q6, p = .059) and that there was no clear leader on the team (q7, p = .067). There were two questions that showed responses that were nearly significant. Question 9 asked whether participants felt they would receive negative consequences from their team if they didn't contribute. The Semi-DM groups reported that they felt this was true to a lesser extent than the other groups (M = 1.88 compared to group mean of 2.967, p = .109). Question 17 asked whether members felt they had a lot of influence over their team's activities. The Semi-DM felt as if they had much more influence (p = .109) and the Semi-BS reported that they felt much less influence over their

group's decision than other teams (p = .109). There was a strong difference between the Semi-BS group and the Semi-DM group compared to the anonymous groups. Both of the semi-anonymous groups reported a much high level of trust on their teams than their anonymous counterparts (Semi-M = 4.63 compared to Anon-M = 3.71, p = .059).

Discussion

The analysis clearly shows that there are significant differences in structure, group psyche, and performance when examining anonymous and semi-anonymous groups. This discussion will first explain the disparity between the groups performing the brainstorming task and the decision making task and then examine the effect varying anonymity has on performance.

Brainstorming Task vs. Decision Making Task

The survey questions dealing with the differing task types were meant as a type of manipulation check to ensure that the groups viewed and reacted to the two tasks differently. While there was a significant difference between the scores for the brainstorming task (M = 39.36%) and the decision making task (M = 32.74%, p = .014), this can be attributed to the fact that the brainstorming task was inherently easier since it required teams to identify any names in the Top 100 and not only focus on the Top 10. No attempt was made to weight the scores with respect to difficulty since these differences were necessary in order to examine how varying degrees of anonymity effects team performance.

The innate difficulty in the decision making task required that leaders and clear roles develop in order for the team to work effectively. The survey results support this conclusion with the decision making groups reporting they felt there was a clear leader on the team significantly more than the brainstorming groups (p = .066). This was also clearly evident when examining the conversation transcripts. Comments such as "hm…what about in high school…what were there lots of," "What do we think is 1?" and "I think we should put them all in until we find something else to replace them" never occurred in the brainstorming groups. Members of teams in decision making tasks took on more defined roles and displayed more leadership because the task itself required it.

The survey results comparing brainstorming and decision making groups supports our hypothesis that teams will approach these tasks differently. Importantly it seems that one of

the primary ways to adapt to a certain task-type is by restructuring the team. This supports our hypothesis that different team structures will be best adapted to certain task-types.

Anonymous vs. Semi-Anonymous Groups

Our analysis in this area returned somewhat unexpected results. Contrary to our original hypothesis the anonymous groups outperformed the semi-anonymous groups in both the brainstorming task and the decision making task. The anonymous groups achieved a mean score of 41.90% across both task types while the semi-anonymous group only averaged a score of 29.55% ($p = .0000$).

It was our original hypothesis that the semi-anonymous groups would feel more pressure to conform then the anonymous groups and that they would feel obligated to contribute for fear of negative consequences from their teammates if they didn't. We did not expect the anonymous groups to feel these pressures as well because they had never met each other in person, were never going to actually meet one another during the experiment, and especially since they interacted under anonymous usernames. However the survey showed that the anonymous group actually felt more pressure to contribute and were more fearful that their teammates would look down upon them for not contributing than the semi-anonymous group.

An explanation for this unpredicted outcome can be found in the answers to the other survey questions. The semi-anonymous groups showed that they had significantly higher level of trust and cohesion than the anonymous groups ($p = .004$). By reading the conversation transcripts it is obvious that they interact much more informally than the anonymous groups. Users from a semi-anonymous group were much more willing to make jokes, interact socially, and admit to their mistakes. Informal conversations like the following were common in the semi-anonymous group:

> upennuser4@yahoo.com says:
> i can't spell!!
> upennuser1@yahoo.com says:
> haha

This would suggest that they are at the performing stage of development suggested by Tuckman and Jensen (1997) where they were most effective at completing tasks. However

their indifference to the quantity and quality of input from their teammates may show that they are in fact past the optimal stage of team development. In our research the high level of trust in the semi-anonymous group did little for their performance. In fact the bi-variate correlation between trust and performance is .234 (p = .085). This means that trust is *negatively correlated* with performance: higher trust is associated with lower performance (and vice-versa). This marginally significant outcome is surprising. It seems that the higher levels of trust on the semi-anonymous teams acted as a hindrance since it prevented team members from processing content more deeply.

The anonymous group on the other hand felt that they needed to prove something to their virtual teammates. No member of the anonymous groups wanted to be the person who held the team back. This created additional motivation to contribute to the best of their ability. Research by Hertel *et al.* (2005) showed that the Kohler effect can be found in virtual groups. This could have occurred in our experiment where participants worked harder in expectation that they would be the weakest member of the team. They knew that if they didn't perform well then their team would fail.

While high levels of trust may have prevented the semi-anonymous groups from critically evaluating contributions, it did contribute to team members feeling freer to suggest unusual ideas (q3, p = .023), as well as encouraging all members to contribute equally (q8, p = .002), and it also ensured that all opinions were received by the team equally (q19, p = .0003). However in our case these benefits did not lead to strong performance by the high trust groups. It seems that the ability to freely exchange information does not lead a priori to good performance. While free information exchange is important, evaluation and critical examination of the information is also imperative to team success. The surveys show that the information exchanged by the semi-anonymous was not evaluated sufficiently and likely led to their low performance. In addition there was no significant correlation between the high-level of trust and feeling accountable to the team (q12, p = .168) or feeling free to question others (q16, p = .317). This shows that the high trust created a feeling of security where members knew that the likelihood of receiving negative consequences from their teammates was low. This result is most crucial in the decision making task since critical assessment of information is necessary for the group to work effectively and perform to a high standard.

Four-way Condition Analysis: Anonymity vs. Task Type

The previous analysis has examined the effects of differing degrees of anonymity and task type, but the combined outcomes have yet to be inspected. An analysis of the four-way condition table shows that our original hypothesis was false; instead anonymous groups performed better on both brainstorming and decision making tasks. We believe that main reason this occurred was because the semi-anonymous groups were too trusting of each other: their high group cohesion and trust actually worked against them. In addition this analysis supported our previous findings that the decision making task required teams to develop a different structure with defined leaders and clear roles in order to work effectively. This adaptation of team structure to the task type was found in both the anonymous and semi-anonymous groups.

Conclusion

The overall analysis of this experiment shows that the hypotheses were not completely supported. The performance outcomes show that the anonymous groups functioned better on the brainstorming task as well as on the decision making task. However when examining the differences between the means of the two groups on each task it is clear that they are linked. While the anonymous group did better on both tasks, they did best on the brainstorming task. Equivalently while the semi-anonymous group did worse on both tasks, they were closest to matching the anonymous group's success on the decision task. Thus to a small degree the hypothesis that each group would do better on a different task is supported.

Another conclusion of this study is that when teams become too trusting and cohesive their performance tends to worsen. It may be that in order for groups to perform optimally only a moderate amount of trust and cohesion should exist between teammates. This would create a small fear of reproach in each member and encourage them to contribute competently. Additionally a small amount of distrust could also lead them to evaluate information more scrupulously since they have less confidence in the informational source. It is clear that in this study, high levels of trust led to less critical examination of information and in the end a lower level of performance. We surmise that the seemingly intuitive idea that the more highly cohesive and trusting a group is the better they will perform may in fact be misguided.

Research by Dirks (1999) supports our conclusion. His results showed that groups with higher levels of trust did not have better performance or better processes than groups with low levels of trust. Instead he found that the main benefit of trust lies in its ability to focus group members on team-level goals rather than on their individual aspirations. In tasks where team and individual goals are already closely aligned (such as in this experiment) trust plays an insignificant role in the performance of a team.

Extending this study to further explore the role of trust in team performance would be worthwhile. It seems that while trust and cohesiveness do allow for teams to align more quickly towards a common goal it can also lead to lower critical evaluation, lower levels of accountability, and a little desire to question others' contributions.

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